



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/566,048

01/26/2006

Shihe Xu

DC5161 PCT1

9408

137 7590 03/02/2009  
DOW CORNING CORPORATION CO1232  
2200 W. SALZBURG ROAD  
P.O. BOX 994  
MIDLAND, MI 48686-0994

EXAMINER

WILSON, MICHAEL H

ART UNIT

PAPER NUMBER

1794

NOTIFICATION DATE

DELIVERY MODE

03/02/2009

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patents.admin@dowcorning.com

<i>Office Action Summary</i>	Application No.	Applicant(s)	
	10/566,048	XU, SHIHE	
	Examiner	Art Unit	
	MICHAEL WILSON	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 12 December 2008.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### *Response to Amendment*

1. This Office action is in response to Applicant's amendment filed 12 December, 2008.

Claims 1-8 are pending.

### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morita (US 5,310,843) in view of Kitano et al. (US 6,544,670), Tang et al. (US 4,769,292), and Mimura et al. (Photoelectric properties of organic polysilane containing carbazoyl side groups).

Regarding claims 1-5, Morita discloses a functional polysiloxane resin comprising units of instant formulae (II) (unit b, abstract; example 7, column 7), and (III) (unit c, abstract; example 7, column 7). The unit of instant formula (II) is disclosed in general in column 2, lines 24-31, and specifically in column 7, line 65 with a  $R^1$  of methyl, an  $R^2$  of ethylene, Z of methoxy, and an n of 0. The reference also discloses a silicone composition comprising a functional polysiloxane resin, a condensation catalyst (column 3, line 54 to column 4, line 2), and an organic solvent (column 5, line 63 to column 6, line 1). The reference also discloses the ratio of “monofunctional” units to “tetrafunctional” units as 0.2:1 to 4:1 (column 2, line 32). However the reference does not explicitly disclose a unit of instant formula (I).

Kitano et al. teach a siloxane polymer for use as a hole transporting polymer in an electroluminescent device (abstract). The reference teaches units similar to instant formula (I) and unit a of Morita (abstract) as hole transporting units (last structure in column 17, line 25; column 16 line 39 to column 17, line 36) where B' is an alkyl and A' is an aromatic amine.

Mimura et al. teach organic polysilanes with carbazolyl side groups (abstract). The reference teaches polysilanes with propylcarbazolyl side chains have high hole mobility (are hole transporting) (page 2198, column 2, lines 2-7).

Tang et al. teach tertiary amine compounds as hole transporting compounds useful for electroluminescent devices (column 36, lines 29-37). The reference further teaches N-carbazoles as equivalent to and interchangeable with tertiary arylamines (column 37, lines 62-68). In view of Tang et al.'s recognition that tertiary arylamines

Art Unit: 1794

and N-carbazoles are equivalent and interchangeable, it would have been obvious to one of ordinary skill in the art to substitute tertiary arylamine of Kitano et al.'s siloxane unit with N-carbazoles and thereby arrive at the present invention. Case law holds that the mere substitution of an equivalent (something equal in value or meaning, as taught by analogous prior art) is not an act of invention; where equivalency is known to the prior art, the substitution of one equivalent for another is not patentable. See *In re Ruff* 118 USPQ 343 (CCPA 1958).

Further it would be obvious to one of ordinary skill in the art at the time of the invention to bind the N-carbazole to the Si atom through an alkyl as demonstrated by Mimura et al. (Figure 1). One of ordinary skill in the art would be motivated by the teachings of Mimura et al. that use of an alkyl linkage is suitable and results in a polymer with high hole mobility.

It would be obvious to one of ordinary skill in the art at the time of the invention to add the carbazolyl-siloxane unit of modified Kitano et al. (Kitano combined with Mimura and Tang et al.) to the polymer of Morita. One of ordinary skill in the art would reasonably expect such a combination to be suitable given both references teach polysiloxane compositions. One of ordinary skill in the art would be motivated by a desire to produce a hole transporting polysiloxane.

Regarding the mole ratio of instant units (I) to instant units (II), Morita discloses the ratio of monofunctional "a" units to tetrafunctional "c" units and "b" units to "c" units as 0 to 4 and 0.05 to 4 (column 2, lines 29-30). Units "a" and "b" comprise all the monofunctional units disclosed by Morita. The ratio of monofunctional "a" units to "b"

Art Unit: 1794

units could be calculated to be 80:1 to 0:100 (a:b or instant (I):(II)). While Morita does disclose a broader range in ratio, the ratio is not considered to confer patentability to the claims as varying mole ratios would clearly effect the desired properties of the polysiloxane, one of ordinary skill in the art would consider the ratio a result effective variable, optimized through routine experimentation. As such, without showing unexpected results, the mole ratio cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the mole ratio of units (I) and (II) in the polysiloxane resin of modified Morita to obtain the hole transporting and compatibility with organic resins (column 3, line46) (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

5. Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitano et al. (US 6,544,670) in view of Morita (US 5,310,843), Tang et al. (US 4,769,292), and Mimura et al. (Photoelectric properties of organic polysilane containing carbazolyl side groups).

Regarding claims 6 and 7, Kitano et al. disclose an organic light-emitting diode comprising, a substrate having a first opposing surface and a second opposing surface (column 27, lines 3-5); a first electrode layer overlying the first opposing surface (column 22 lines 62-65; column 27, lines 1-5); a light-emitting element overlying the first

Art Unit: 1794

electrode layer (column 23, lines 8-9), the light emitting element comprising a hole-transport layer and an electron-transport layer (column 23, lines 15-22). The light-emitting layer which lies on the hole transport layer will intrinsically also function as an electron-transport layer and can be thought of as a light-emitting and electron transporting layer in the two layer device of Kitano et al. The reference also discloses a polysiloxane resin as part of the hole transporting layer (column 23, lines 15-22). Kitano et al. teach a siloxane polymer for use as a hole transporting polymer in an electroluminescent device (abstract). The reference teaches units similar to instant formula (I) as hole transporting units (last structure in column 17, line 25; column 16 line 39 to column 17, line 36) where B' is an alkyl and A' is an aromatic amine. However the reference does not explicitly disclose a polysiloxane resin with units of instant formulae (I) to (III).

Mimura et al. teach organic polysilanes with carbazolyl side groups (abstract). The reference teaches polysilanes with propylcarbazolyl side chains have high hole mobility (are hole transporting) (page 2198, column 2, lines 2-7).

Tang et al. teach tertiary amine compounds as hole transporting compounds useful for electroluminescent devices (column 36, lines 29-37). The reference further teaches N-carbazoles as equivalent to and interchangeable with tertiary arylamines (column 37, lines 62-68). In view of Tang et al.'s recognition that tertiary arylamines and N-carbazoles are equivalent and interchangeable, it would have been obvious to one of ordinary skill in the art to substitute tertiary arylamine of Kitano et al.'s siloxane unit with N-carbazoles and thereby arrive at the present invention. Case law holds that

Art Unit: 1794

the mere substitution of an equivalent (something equal in value or meaning, as taught by analogous prior art) is not an act of invention; where equivalency is known to the prior art, the substitution of one equivalent for another is not patentable. See *In re Ruff* 118 USPQ 343 (CCPA 1958).

Further it would be obvious to one of ordinary skill in the art at the time of the invention to bind the N-carbazole to the Si atom through an alkyl as demonstrated by Mimura et al. (Figure 1). One of ordinary skill in the art would be motivated by the teachings of Mimura et al. that use of an alkyl linkage is suitable and results in a polymer with high hole mobility.

Morita teaches a functional polysiloxane resin comprising units of instant formulae (II) (unit b, abstract; example 7, column 7), and (III) (unit c, abstract; example 7, column 7). The unit of instant formula (II) is disclosed in general in column 2, lines 24-31, and specifically in column 7, line 65 with an R<sup>1</sup> of methyl, an R<sup>2</sup> of ethylene, Z of methoxy, and an n of 0. The reference also discloses a silicone composition comprising a functional polysiloxane resin, a condensation catalyst (column 3, line 54 to column 4, line 2), and an organic solvent (column 5, line 63 to column 6, line 1). Morita also discloses the ratio of “monofunctional” units to “tetrafunctional” units as 0.2:1 to 4:1 (column 2, lines 6-31). The reference also teaches polysiloxanes with units of instant formulae (II) and (III) form good organic resin coatings, and promote adhesion (column 6, lines 18-20).

It would be obvious to one of ordinary skill in the art at the time of the invention to add the units of instant formulae (II) and (III) to the polymer of Kitano et al. One of

Art Unit: 1794

ordinary skill in the art would reasonably expect such a combination to the suitable given both references teach polysiloxane compositions. One of ordinary skill in the art would be motivated by a desire to promote adhesion and form good organic resin coatings (column 6, lines 18-20).

Regarding the mole ratio limitations, while modified Kitano et al. discloses a broader range in ratio, the ratio is not considered to confer patentability to the claims as varying mole ratios would clearly effect the desired properties of the polysiloxane, one of ordinary skill in the art would consider the ratio a result effective variable, optimized through routine experimentation. As such, without showing unexpected results, the mole ratio cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the mole ratio of monomer units in the polysiloxane resin of modified Kitano et al. to obtain the hole transporting and compatibility with organic resins (column 3, line 46) (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

Regarding claim 8, modified Kitano et al. disclose all the claim limitations as set forth above. Additionally the reference discloses the polysiloxane resin as part of the light-emitting layer in a single layer device (column 23, lines 5-12), and in the hole transport layer in a two layer device (column 23, lines 14-22). However the reference

Art Unit: 1794

does not explicitly disclose the polysiloxane resin in the electron transporting light-emitting layer.

It would be obvious to one of ordinary skill in the art at the time of the invention to include the polysiloxane resin in the electron transporting light-emitting layer given that Kitano et al. teach the polymer as suitable for a light-emitting layer which must also function as electron transporting (column 23, lines 5-12). One of ordinary skill would be motivated by a desire to make the electron transporting light-emitting layer more hole transporting.

### *Response to Arguments*

6. Applicant's arguments filed 12 December, 2008 have been fully considered but they are not persuasive.

Applicant respectfully submits the Office failed to determine the scope and content of the prior art, and subsequently failed to ascertain the differences between the prior art and the claims at issue. Absent such inquiry, the Office has apparently used the Applicant's teaching to search through the prior art for the claimed elements and then attempted to combine them as claimed. However the examiner respectfully disagrees and notes that the scope and content of the prior art as well as the differences between the prior art and the present invention are ascertained and distinctly pointed out in the rejections of record.

Concerning Morita (US 5,310,843) applicant argues Morita does not teach a polysiloxane resin containing siloxane units having a carbazolyl group or any other

Art Unit: 1794

nitrogen-containing group attached to silicon through an alkylene group having 3 to 10 carbon atoms. Moreover, applicant argues that the reference does not teach or suggest a silicone composition comprising a functional polysiloxane resin, a condensation catalyst, and an organic solvent. Applicant also argues that Kitano et al. (US 6,544,670 B1) neither contains a carbazolyl group nor a divalent alkylene group having 3 to 10 carbon atoms linking the nitrogen atom to the silicon atom of the siloxane unit. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Morita alone is not used to teach the above missing features. Instead Morita in view of Kitano et al., Tang et al. (US 4,769,292), and Mimura et al. (Photoelectric properties of organic polysilane containing carbazolyl side groups) are used to teach polysiloxane resin containing siloxane units having a carbazolyl group attached to silicon through an alkylene group having 3 to 10 carbon atoms, and Kitano et al. in view of Morita, Tang et al., and Mimura et al. is used to teach a carbazolyl group or a divalent alkylene group having 3 to 10 carbon atoms linking the nitrogen atom to the silicon atom of the siloxane unit.

Regarding Tang et al. applicant argues that Tang et al. do not teach or suggest that substituent groups derived from N-substituted carbazole compounds are equivalent and interchangeable with the tertiary amine substituent groups in the siloxane polymer of Kitano et al. for the purpose of hole transport. However Tang et al. teach compounds

Art Unit: 1794

“containing at least one hole transporting aromatic amine” (column 36, lines 29-34) which clearly does not exclude carbazole as a substituent since it would be understood by one of ordinary skill in the art that compounds “contain” substituents. Further Tang et al. disclose polyvinylcarbazole (PVK) as an example (column 38, line 15). PVK is a polymer with a polyethylene backbone and carbazole side chains, or substituents. Therefore one of ordinary skill in the art would recognize that the reference teaches arylamines in general and carbazole in particular are a group suitable and desirable for hole transporting compounds.

Applicant also argues that the hole transport properties of a carbazolyl-substituted siloxane are not due merely to the carbazolyl substituent independent of its macromolecular environment. Rather, applicant asserts, the hole transport properties of a carbazolyl-substituted siloxane are influenced by many factors, including polymer structure, conformation, composition, and molecular weight. However the examiner is not arguing that the hole transport property is independent of the macromolecular environment, but merely that the tertiary arylamine groups in the polymer of Kitano et al. are equivalent and interchangeable with carbazole, a tertiary arylamine, in view of Tang et al. Further it is noted that Kitano et al. teach the *unmodified* polymer as hole transporting therefore carbazole is not used to give hole transport properties to an otherwise non-hole transporting polymer.

Regarding Mimura et al. applicant argues that the reference does not teach or suggest that replacing an arylene linkage in a (hypothetical) carbazolyl-substituted polysiloxane having an -Si-O-Si- backbone would result in a siloxane polymer having

high hole mobility. However this reference is not used to teach a polysiloxane backbone. Rather Mimura et al. is used to teach organic polysilanes containing carbazolyl side groups linked to silicon through a propylene linkage have higher hole drift mobilities. Kitano et al. teach polysiloxane excellent hole transport properties (hole mobility). Mimura et al. teach polysilane without carbazole also excellent hole mobility but with carbazolylpropyl side chains the polysilane retains excellent hole mobility and further improves in efficiency (see figure 4, page 2200) over the original polysilane. Similarly one of ordinary skill would be able to infer that polysiloxane, which already possesses excellent hole transport property (hole mobility) would improve in hole transport property (hole mobility) and further improves in efficiency.

Additionally applicant argues that polysilanes are electrically conductive while polysiloxanes are electrically nonconductive, the hole mobility of a carbazolylpropyl-substituted polysiloxane can not be reasonably inferred from the hole mobility of a carbazolylpropyl-substituted polysilane. However given that Kitano et al. teach polysiloxanes to be hole transporting giving one of ordinary skill in the art the necessary knowledge to infer the hole mobility as suitability of a carbazolylpropyl-substituted polysiloxane.

### *Conclusion*

7. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Art Unit: 1794

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL WILSON whose telephone number is (571) 270-3882. The examiner can normally be reached on Monday-Thursday, 7:30-5:00PM EST, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Callie Shosho can be reached on (571) 272-1123. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1794

9. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MHW

/Callie E. Shosho/  
Supervisory Patent Examiner, Art Unit 1794